IN THE SPECIFICATION:

Please replace paragraph number **[0003]** with the following rewritten paragraph:

[0003] Conventional cutting element retention systems generally comprise two styles: (1) ~~a tungsten~~ tungsten carbide studs comprising a cylindrical tungsten carbide cylinder having a face oriented at an angle (backrake angle) with respect to the longitudinal axis of the cylinder, the face carrying a superabrasive cutting structure thereon, wherein the cylinder is press-fit into a recess that is generally oriented perpendicularly to the blades extending from the bit body on the bit face; and (2) mechanical and/or brazed attachment of a generally cylindrical cutting element into a recess formed on the bit face, typically on a blade extending therefrom. Regarding the first cutting element retention style, PDC cutting elements may be brazed to the face, or other superabrasive structures may be affixed thereto, by infiltration or brazing, such as thermally stable diamonds (TSPs). Accordingly, the first cutting element retention style is designed for a stud-type cutting element, while the second cutting element retention style is designed for generally cylindrical cutting elements, such as PDC cutters. In either system, the goals are to provide sufficient cutting element attachment and retention as well as mechanical strength sufficient to withstand the forces experienced during the drilling operation.

Please replace paragraph number **[0008]** with the following rewritten paragraph:

[0008] Cutting element pockets 30 formed in blades 34 are of a general right cylindrical shape as shown in FIG. 1A and 1B. As may be further seen with respect to FIGS. 1A and 1B, cutting element pockets 30 proximate the inner radial region 26 of conventional steel body rotary drill bit body 10 may be difficult to form conventionally. Further, as blades 34 extend nearer to one another, especially within the inner radial region 26 of conventional steel body rotary drill bit body 10, conventional cutting element pockets 30 may become difficult to form. As may be further noted, a cutting element pocket 30 ~~of~~ of a conventional steel body rotary drill bit body 10 may not fully support the substantially planar surface of a cutting element disposed therein because the cutting element pocket 30 may extend only to the top surface of the blade. However,

the conventional cutting element pockets 30 may be machined in such a way as to form supporting backings (not shown) that extend above the upper surface of the blade 34, in conformity with the substantially planar surface of a generally cylindrical cutting element (not shown), but such machining may be time intensive and expensive.

Please replace paragraph number **[0013]** with the following rewritten paragraph:

[0013] Therefore, it would be advantageous to provide an improved cutting element retention configuration for use in steel body rotary drag bits. Further, it would be advantageous to provide a cutting element retention apparatus that is implementable by way of conventional machining equipment and improves flexibility of design. In ~~addition~~ addition, it would be advantageous to provide a cutting element retention apparatus that provides mechanical locking of at least a portion of the cutting element within the steel body rotary drill bit.

Please replace paragraph number **[0025]** with the following rewritten paragraph:

[0025] FIG. 2D shows a front ~~cross~~ cross-sectional view of the support element disposed within the recess as shown in FIG. 2C;

Please replace paragraph number **[0026]** with the following rewritten paragraph:

[0026] FIG. 2E shows a perspective view of the assembled cutting element retention apparatus of FIG. ~~2A.~~ 2A;

Please replace paragraph number **[0030]** with the following rewritten paragraph:

[0030] FIG. 4C shows a perspective view of the assembled cutting element retention apparatus ~~show~~ shown in FIG. 4A;

Please replace paragraph number **[0032]** with the following rewritten paragraph:

[0032] FIG. 4E ~~show~~ shows a top view of ~~the a~~ the generally cylindrical cutting element disposed within the cutting element pocket as shown in FIG. 4D;

Please insert paragraph number **[0033.1]** directly below paragraph number **[0033]** and also insert the following paragraph:

[0033.1] FIG. 4G shows a side cross-sectional view of a further embodiment of an assembled cutting element retention apparatus of the present invention;

Please replace paragraph number **[0034]** with the following rewritten paragraph:

[0034] FIG. 5A shows a side ~~cross~~ cross-sectional view of a recess formed within a bit ~~blade~~ blade;

Please replace paragraph number **[0037]** with the following rewritten paragraph:

[0037] FIGS. 6B-6D show perspective, side, and front ~~views~~ views, respectively, of a support element of the present invention;

Please replace paragraph number **[0041]** with the following rewritten paragraph:

[0041] FIGS. 8A and 8B show perspective and top ~~views~~ views, respectively, of a steel body rotary drill bit according to the present invention.

Please replace paragraph number **[0042]** with the following rewritten paragraph:

[0042] FIG. 2A shows an exploded perspective assembly view of a first embodiment of the cutting element retention apparatus 110 of the present invention. More specifically, FIG. 2A shows a bit blade 130 having a recess 122 formed therein sized and configured to accept a support element 114 and generally cylindrical cutting element 112 having a cutting face 113 and distal substantially planar surface 115. Recess 122 may be partially cylindrical or arcuate at its lowermost surface and may therefore be formed by way of a machining bit blade 130 with a hemispherical or at least partially spherical ended tool along a straight path between leading face 123 and trailing face 124 thereof. Leading face 123 generally refers to the region of the bit blade 130 that is rotationally forward or leading in relation to the direction of rotation of the bit body during drilling. Support element 114 may comprise a generally cylindrically shaped body

having an aperture 116 formed through the circumference thereof and a front ~~face~~ surface 117 configured to matingly engage and support a cylindrical cutting element 112 disposed therein, as illustrated by FIGS. 2A and 2B, FIG. 2B showing a front view of the support element 114.

Please replace paragraph number **[0043]** with the following rewritten paragraph:

[0043] FIG. 2C shows a perspective view of the assembled cutting element retention apparatus 110 as shown in FIG. 2A wherein support element 114 is disposed within recess 122. Further, FIG. 2D shows a cross-sectional view of the cutting element retention apparatus 110 as shown in FIG. 2C, the cross-sectional view taken perpendicular ~~to~~ to the direction of the axis of the arcuate surface of the recess 122. Support element 114 disposed within recess 122 may be affixed to bit blade 130, at least partially, by way of anchor element 118 disposed within aperture 116 as well as corresponding retention recess 120 formed in bit blade 130. Anchor element 118 may engage support element 114 and may fit within aperture 116 and/or retention recess 120 by interference fit or by sliding fit. Thus, support element 114 may be disposed within recess 122 to form cutting element pocket 126.

Please replace paragraph number **[0044]** with the following rewritten paragraph:

[0044] Of course, as shown in FIG. 2E, generally cylindrical cutting element 112 may be preferably disposed within cutting element pocket 126 (FIG. 2C) so that at least a portion of substantially planar surface 115 thereof matingly engages front surface 117 of support element 114. Such a configuration may provide support for the generally cylindrical cutting element 112 during drilling. Additionally, generally cylindrical cutting element 112 may be affixed to the bit blade 130 and/or support element 114 via brazing, welding, or as otherwise known in the art. Of course, brazing or welding may also secure any of the anchor element 118, support element 114, and/or bit blade 130 to one another. Alternatively, anchor element 118 may be designed to deform within retention recess 120 and/or aperture 116 to affix the support element 114 to the bit blade 130. Accordingly, anchor element 118 may extend through, engage against, or fit interferingly in relation to the support element 114. Thus, support element 114 and

anchor element 118 may position generally cylindrical cutting element 112 within the cutting element pocket 126 (FIG. 2C) and also support the generally cylindrical cutting element 112, in combination with subsequent brazing and/or welding, against forces experienced while drilling.

Please replace paragraph number **[0047]** with the following rewritten paragraph:

[0047] FIGS. 3A-3F illustrate a cutting element retention apparatus 110 of the present invention, including an exemplary process which may be used in the formation thereof. Further, FIGS. 3A-3F illustrate a cutting element retention apparatus 110 that disposes a generally cylindrical cutting element 112 at a selected backrake angle 128. FIG. 3A shows a cross-sectional view of bit blade 130 having a leading ~~surface~~ face 123 and a trailing ~~surface~~ face 124. Reference axis 127 is parallel to the longitudinal axis of the drill bit (not shown). Bit blade 130 also includes upper surface 125 as well as chamfer 129. Chamfer 129 is sized and configured so that the cutting face 113 of generally cylindrical cutting element 112 may not be disposed within the arcuate surface of recess 122. Such a configuration may improve the ability to remove cuttings from the cutting face 113 of the generally cylindrical cutting element 112. Of course, the bit blade 130 shape may be tapered, rounded, or arcuately shaped in extending from the bit body (not shown) along both the leading face 123 and trailing face 124.

Please replace paragraph number **[0048]** with the following rewritten paragraph:

[0048] FIG. 3B shows a cross-sectional view of a machining operation in the process of forming recess 122. As shown in FIG. 3B, upper surface 125 of bit blade 130 may taper toward the bit body (not shown) to allow for clearance with respect to the formation during drilling thereof. As also shown in FIG. 3B, machining tool 140 may comprise a hemispherical end 143. Machining tool 140 is moved along a straight line along direction 141 between leading ~~surface~~ face 123 and trailing ~~surface~~ face 124 to form recess 122. FIG. 3C shows a cross-sectional view of recess 122 extending through the thickness t of bit blade 130. FIG. 3D shows a cross-sectional view of recess 122 wherein retention recess 120 is oriented substantially perpendicular to the direction 141 of formation of recess 122. Of course, other orientations of the retention

recess 120 are contemplated by the present invention, depending on the geometry and configuration of the support element 114, bit blade 130, and generally cylindrical cutting element 112. Further, FIG. 3E shows support element 114 disposed within recess 122 affixed to bit blade 130 by way of anchor element 118 disposed within aperture 116 of support element 114 as well as retention recess 120 of bit blade 130. Support element 114, as shown in FIG. 3E, forms cutting element pocket 126 wherein front ~~face~~ surface 117 of support element 114 is oriented at a backrake angle 128 with respect to reference axis 127. FIG. 3F shows a cross-sectional view of cutting element 112 disposed within recess 122, wherein at least a portion of the substantially planar surface 115 of the cutting element 112 matingly engages the front surface 117 of support element 114. Thus, cutting face 113 of cutting element 112 may be disposed at backrake angle 128 with respect to reference axis 127. Cutting element 112, as shown in FIG. 3F, may comprise a superabrasive layer 134 which forms cutting face 113 affixed to substrate 132, such as in the case of a PDC cutter.

Please replace paragraph number **[0051]** with the following rewritten paragraph:

[0051] FIGS. 4A-4F depict another embodiment of the cutting element retention apparatus 210 the present invention wherein recess 222 may be formed by a machining tool (not shown) having a hemispherical or at least partially spherical end that is moved along a straight path between the leading face 223 and trailing face 224 of bit blade 230, as shown in FIGS. ~~3A-3C~~ 4A-4C. Also, cutting element retention apparatus 210 may include support element 214 disposed within retention recess 220. As shown in FIGS. 4A and 4B, support element 214 may be shaped cylindrically, and may include front surface 217 for matingly engaging at least a portion of the substantially planar surface 215 of generally cylindrical cutting element 212. Support element 214 may also include alignment groove 216 and intermediate surface 219. Intermediate surface 219 may be substantially planar, or may be arcuate. Thus, intermediate surface 219 may be complementarily shaped with respect to the side of a generally cylindrical cutting element 212 in order to accept at least a portion of the circumference thereof

upon assembly of support element 214 within retention recess 220 and generally cylindrical cutting element 212 within cutting element pocket 226, as shown in FIG. 4C.

Please replace paragraph number **[0053]** with the following rewritten paragraph:

[0053] FIG. 4E shows a cross-section of the assembled cutting element retention apparatus 210 of the present invention, as shown in FIG. ~~3C~~ 4C, wherein generally cylindrical cutting element 212 is disposed so that at least a portion of substantially planar surface 215 matingly engages front surface 217 of support element 214. Front surface 217 may be sized to substantially the same size as the substantially planar surface 215 of generally cylindrical cutting element 212 to provide support thereto. Alternatively, front surface 217 may be sized larger than or smaller than the substantially planar surface 215 of generally cylindrical cutting element 212. Generally cylindrical cutting element 212 may comprise a superabrasive ~~layer~~ layer 234 forming cutting face 213 affixed to substrate 232, such as in the case of a PDC cutter.

Please replace paragraph number **[0054]** with the following rewritten paragraph:

[0054] FIG. 4F shows a cross-sectional view of the assembled cutting element retention apparatus 210 as shown in FIG. 4C, depicting generally cylindrical cutting element 212 disposed within recess 222 so that at least a portion of substantially planar surface 215 of the generally cylindrical cutting element 212 matingly engages the front surface 217 of support element 214. Support element 214 may be disposed within retention recess 220 and oriented by way of alignment pin 218 disposed between alignment groove 216 of the support element 214 and alignment groove 221 of the retention recess 220. Cutting face 213 of generally cylindrical cutting element 212 may be disposed at backrake angle 228 with respect to reference axis 227 according to the geometry and orientation of the recess 222, support element 214, and retention recess 220. Generally cylindrical cutting element 212, as shown in FIG. 4F, may comprise a superabrasive layer 234 which forms cutting face 213 affixed to substrate 232, such as in the case of a PDC cutter. Many design alternatives are possible and are contemplated by the present invention, for instance, orienting the front ~~face~~ surface 217 of the support element 214 with

respect to the direction of rotation of the generally cylindrical cutting element 212 may provide side rake to the cutting face 213 thereof, as known in the art.

Please replace paragraph number **[0058]** with the following rewritten paragraph:

[0058] Recess 322 may be formed within bit blade 330 as described in FIGS. 3A-3B in relation to bit blade 130 and may include arcuate surface 331, hemispherical surface 333, and arcuate surface 335 as formed thereby. Such a process may be advantageous where clearance for machining is limited. However, hemispherical surface 333 may complicate formation of a cutting element pocket for a generally cylindrical cutting element. Therefore, as seen in FIG. 5B, retention recess 320 may be sized and positioned to remove the hemispherical surface 333 as well as arcuate surface 335. Alternatively, where adequate clearance for machining exists, the retention recess 320 may be machined prior to machining recess 322. As shown in FIG. 5B, support element 314 may be disposed within retention recess 320 to form or define a cutting element pocket 326 for affixing generally cylindrical cutting element 312 within. Generally cylindrical cutting element 312 may comprise a superabrasive layer 334 affixed to substrate 332, such as in the case of a PDC cutter.

Please replace paragraph number **[0062]** with the following rewritten paragraph:

[0062] FIGS. 6A-6D illustrate one embodiment of a mechanically locked cutting element retention apparatus 410. As shown in FIG. 6A, recess 422 formed within bit blade 430 may be cylindrical and may be sized and configured to surround more than half of a cross-sectional circumference of a generally cylindrical cutting element disposed therein. As such, a cutting element (not shown) disposed within recess 422 and brazed therein may be retained, notwithstanding fracturing of a portion of the generally cylindrical cutting element (not shown). Retention recess 420, formed within bit blade 430, may also include alignment groove ~~416~~ 421 for orienting support element 414 therein by way of an alignment pin (not shown) as described hereinabove with respect to FIGS. 4A-4F.

Please replace paragraph number **[0063]** with the following rewritten paragraph:

[0063] FIGS. 6B-6D illustrate a perspective, side, and front views, respectively, of support element 414 configured to support a generally cylindrical cutting element (not shown) disposed within recess 422 upon disposing the support element 414 within retention recess 420. Support element 414 may be press-fit, brazed, shrink-fit, welded, or otherwise affixed to bit blade 430. As shown in FIGS. 6B-6D, support element 414 may be cylindrical and may include front surface 417 for matingly engaging at least a portion of a substantially planar surface of a generally cylindrical cutting element (not shown) as described hereinabove. Support element 414 ~~also~~ may also ~~includes~~ include alignment groove 416 and intermediate surface 419. Intermediate surface 419 may be cylindrical, and may be sized and configured to accept the circumference of a generally cylindrical cutting element (not shown).

Please replace paragraph number **[0067]** with the following rewritten paragraph:

[0067] FIG. 7B shows a cross-sectional view of cutting element retention apparatus 511 wherein support element 514 is disposed within retention recess 520, generally cylindrical cutting element 512 is disposed within cutting element pocket 526, and secondary structure 560 is disposed within cavity 550. Secondary structure 560 may be brazed, welded, press-fit, or shrink-fit within cavity 550. Secondary structure 560 may be disposed within cavity 550 and may be configured to limit the rate-of-penetration or depth-of-cut of the generally cylindrical cutting element by contacting the formation during drilling. As known in the art, the secondary structure 560 may be sized and configured to contact the formation under selected drilling conditions. Also, retention recess 520 may be formed within bit blade 530 for retaining support element 514 as described in relation to any of the above-mentioned cutting element retention apparatus embodiments. Generally cylindrical cutting element 512 may comprise a superabrasive layer 534 affixed to substrate 532, such as in the case of a PDC cutter.

Please replace paragraph number **[0068]** with the following rewritten paragraph:

[0068] FIG. 8A and 8B show a perspective view and a top view, respectively, of an example of an exemplary steel body rotary drill bit 601 of the present invention, wherein cutting element pockets 640, 642, 644, 646, and 648 may be at least partially formed by support elements 612, 614, 616, 618, and 620, respectively. Steel body rotary drill bit 601 may also include generally cylindrical cutting elements 650 affixed to radially and longitudinally extending blades 634, nozzle cavities 639 for communicating drilling fluid from the interior of the steel body rotary drill bit 601 to the cutting elements 650, face 638, and threaded pin connection ~~for~~ 660 for connecting the steel body rotary drill bits to a drilling string, as known in the art.

Please replace paragraph number **[0069]** with the following rewritten paragraph:

[0069] Support elements 612, 616, and 620 may comprise any of the above-described embodiments of the present invention. However, more specifically, as shown in FIG. 8B, support element 614 may be disposed within recess 615 that extends through blade 634 and may be affixed thereto by anchor element 617, extending through support element 614. Also as shown in FIG. 8B, secondary structure 625 may rotationally follow or trails in relation to support element 612 and its associated cutting element 650. Additionally, cutting element pocket 648, formed at least in part by support element 622 may surround more than half of a cross-sectional circumference of the generally cylindrical cutting element 650 disposed therein. Support elements 616 and 618 may be press-fit or shrink-fit into a retention recess within their associated blades 634 or face 638 proximate thereto of the steel body rotary drill bit 601. Cutting element 650 may comprise a superabrasive layer 651 affixed to a substrate 653, such as a PDC cutter.

Please replace paragraph number **[0071]** with the following rewritten paragraph:

[0071] While the present invention has been described herein with respect to certain preferred embodiments, those of ordinary skill in the art will recognize and appreciate that it is

not so limited. Rather, many additions, deletions and modifications to the preferred embodiments may be made without departing from the scope of the invention as hereinafter claimed. In addition, features from one embodiment may be combined with features of another embodiment while still being encompassed within the scope of the invention as contemplated by the inventors. Further, the invention has utility ~~in with~~ with different and various bit profiles as well as cutter types and configurations.